CHEMISTS
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Expera Specialty Solutions LLC
Recovery Boilers 8&10 Emission Test
at

Kaukauna, WI
November 6, 2014
Project # 14-0042A

Prepared by:

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PARTICULATE EMISSION RESULTS-TOTAL

11/06/2014

Volumetric Flow Rate dscfm	BTU Input Per Hour (MM)	Particulate Emission lbs./hr.	lbs./MM Btu	gr./dscf corr. to 8% O2
128,141	426	**25.8**	**0.03**	**0.018**
State Limitations		49.5	0.30	
MACT II Limitation				0.036

The lbs./hr and lbs./MM Btu is total Particulate (front and backhalf). The gr/dscf is front half Particulate only. Formula for correcting to 8% Oxygen.

$$C_s 8\% = \frac{13}{21 - \%O_2} C_s$$

PARTICULATE EMISSION RESULTS -ESP Side A

Test Run	Volumetric Flow Rate dscfm	Isokinetic Ratio, %	Particulate Emission gr/dscf corr. to 8% O2	lbs./hr
1	71,654	100.5	0.015	11.60
2	71,347	100.8	0.013	12.77
3	71,091	100.7	0.013	10.12
Average	**71,364**		**0.014**	**11.5**

PARTICULATE EMISSION RESULTS-ESP Side B

Test Run	Volumetric Flow Rate dscfm	Isokinetic Ratio, %	Particulate Emission gr./dscf corr. to 8% O2	lbs./hr
1	57,046	99.7	0.026	14.92
2	56,592	100.0	0.024	13.70
3	56,693	99.7	0.024	14.24
Average	**56,777**		**0.025**	**14.3**

II. Process Description

The testing was performed on the discharge of the two ESP's serving number 8 and 10 recovery boilers. Number 10 boiler is rated at 321.7 MM BTU per hour and number 8 is rated at 205.6 MM BTU per hour. During the emission tests the average combined firing rate was 426 MM Btu per hour. Both boilers are fired with black liquor from plant operations. The Recovery Boiler reports showing operating parameters are contained in the Appendix.

Black liquor samples were taken by Expera personnel and sent to SGS to perform an Ultimate analysis, btu/lb. and solids content. The results of those analyses along with BTU calculations from Expera personnel are contained in the Appendix. The average results of those calculations are shown below.

Fuel Input

Black Liquor Firing Rate, lb./hr	BTU/lb.	BTU/hr
78,594	5,416	426 MM Btu

III. Comments

The testing on November 6, 2014 proceeded normally with no sampling problems that we were aware of except as noted below. To the best of our knowledge the test's results are accurate and indicate the process emissions during the test period. All leak checks and calibrations were within method tolerances.

A split box was used for the particulate sampling because of the constraints of the sampling area which did not allow a full Method 5 sampling hot/cold box assembly. The flexible unheated Teflon sampling line, between the filter and the impingers, was rinsed with acetone/hexane after each test and this rinse was combined with the normal Method 202 acetone/hexane rinse.

Location:		8/10 Rec Blr- Side A		
Date:		11/06/14		
Time:	12:12 13:15	13:35 14:38	14:52 15:55	
Test Run	1	2	3	Average
STACK GAS DATA:				
Temperature:	413.3	412.0	411.2	412.1
Velocity, ft/sec.	58.998	58.776	58.477	58.750
Gas Volume, acfm	156,386	155,799	155,006	155,730
Gas Volume, scfm (wet)	92,777	92,566	92,174	92,506
Gas Volume, scfm (dry)	71,654	71,347	71,091	71,364
Moisture, %	22.8	22.9	22.9	22.9
Carbon Dioxide, % (dry)	10.4	10.6	10.6	10.5
Oxygen, % (dry)	9.4	9.2	9.4	9.3
Nitrogen, % (dry)	80.2	80.2	80.0	80.1
Molecular Weight, (dry)	30.04	30.06	30.07	30.06
Molecular Weight, (wet)	27.30	27.30	27.31	27.30
SAMPLING DATA:				
Total Time, min.	60	60	60	
Volume, dscf	41.516	41.465	41.267	
Isokinetic Ratio, %	100.5	100.8	100.7	
PARTICULATE EMISSION RATES:				
Fronthalf PM (filter & probe H20), mg	35.7	32.2	31.2	33.0
Concentration, grains/dscf	0.0132	0.0120	0.0116	0.0123
Concentration, lbs/dscf	1.8961E-06	1.712E-06	1.667E-06	1.758E-06
Emission Rate, Total lbs/hr.	8.152	7.330	7.111	7.531
Concentration, grains/dscf Corrected to 8% O2	**0.0148**	**0.0132**	**0.0130**	**0.0137**
Total Particulate Collected, mg	50.8	56.1	44.4	50.4
Concentration, grains/dscf	0.0188	0.0208	0.0166	0.0187
Concentration, lbs/dscf	2.698E-06	2.983E-06	2.372E-06	2.685E-06
Emission Rate, Total lbs/hr.	**11.600**	**12.771**	**10.119**	**11.497**
Emission Rate, lb/1000 lb Stack Gas	0.0294	0.0325	0.0258	0.0292
Btu Input, MM/hr	395	433	455	428
Emission Rate, lb/MM BTU	**0.029**	**0.029**	**0.022**	**0.027**

Expera Thilmany Mill B08 and B10 Recovery Boilers PM Test Process Data- November 6, 2014

					rb8-nozzle	cr-rb8-prod-rate.filt		rb10-nozzle_fl	cr-rb10-prod-rate.filt						rb-a.side.opacity	rb-b.side.opacity
	Start	End	Run	ESP/ Stack ID	8 Boiler Black Liquor Flow; GPM	8 Boiler Black Liquor Solids Fired; TPD		10 Boiler Black Liquor Flow; GPM	10 Boiler Black Liquor Solids Fired; TPD	8 and 10 Boilers Combined Black Liquor Solids Fired; TPD	Total Black Liquor Solids Fired; LBS. BLS/HR	Black Liquor Heat Content; BTU/DRY LB	8 and 10 BoilersTotal Heat Input; MMBTU/HR	% of Rated Heat Input Capacity	A Stack Ave Opacity; %	B Stack Ave Opacity; %
	11/6/2014 7:30	11/6/2014 8:32	1	B/ S10	71.5	391.2		98.6	538.3	929.5	77458	5379	417	79.0	3.7	5.2
	11/6/2014 8:50	11/6/2014 9:53	2	B/ S10	72.9	401.9		99.4	547.3	949.2	79100	5373	425	80.6	4.0	5.2
	11/6/2014 10:10	11/6/2014 11:13	3	B/ S10	73.3	405.4		99.4	542.1	947.5	78958	5435	429	81.4	4.1	5.3
	11/6/2014 12:12	11/6/2014 13:15	4	A/ S08	73.0	406.4		98.9	542.4	948.8	79067	4998	395	74.9	4.5	5.3
	11/6/14 13:35	11/6/2014 14:38	5	A/ S08	73.5	401.5		99.0	540.3	941.8	78483	5513	433	82.1	4.2	5.0
	11/6/14 14:52	11/6/2014 15:55	6	A/ S08	73.2	402.2		99.4	539.8	942.0	78500	5801	455	86.4	4.4	4.9
		AVERAGE			72.9	401.4		99.1	541.7	943.1	78594	5416	426	80.7	4.2	5.2

from SGS Analysis Report

	BTU/LB as rec'd	% Solids	BTU/LB dry
Run 1	3842	71.43	5379
Run 2	3896	72.51	5373
Run 3	3779	69.53	5435
Run 4	3624	72.51	4998
Run 5	3778	68.53	5513
Run 6	3861	66.56	5801
AVE	3797	70.18	5416